PRIORITIZED GMI ACTION ITEMS

Based on group discussion at the September, 2010, GMI Science Team Meeting

A. High priority and short term action items (0-6 month timescale)

1. RESOLVE O(^{1}D) PRODUCTION ISSUE

Rodriguez, Yantosca, Logan, Natarajan. Intercompare FAST JX codes to identify the cause(s) of differences between GMI and GEOS-CHEM O^1D. Bob Yantosca has a standalone version of FAST JX that he is willing to run using inputs from GMI. GMI will provide the necessary inputs for Bob. Probable causes include overhead O3 and the calculation of optical depth from clouds (e.g., random vs. maximum overlap).

2. RUN GMI CTM with GEOS5/MERRA (2004 – PRESENT)

Megan. Megan is processing and running the GMI CTM with MERRA fields right now for the ARRA (stimulus) project requirements. Susan is looking at the output as it is produced. Note that this simulation will probably not be the final GMI-MERRA simulation because we will want to add the chemistry-aerosol coupling once testing is completed. Also, if correctable FAST JX issues are discovered during item 1 (above), then these changes would also be implemented before a 'final' simulation with the MERRA fields.

3. UPDATE LIGHTNING PARAMETERIZATION FOR GMI-MERRA

Dale, Megan. Dale Allen has derived the necessary new lightning NOx parameterization, based on MERRA convective mass fluxes for 2004-5. Megan has implemented them in the GMI code and they are being used in the new MERRA simulation. As we expand the MERRA simulation beyond the Aura period, for example for a hindcast run, Dale will update the MERRA parameterization.

4. PROCESSING MERRA MET. FIELDS

Megan, Jose. On October 8, Megan and Jose met with Bob Yantosca to discuss how processing of GEOS met fields differs between GEOS-Chem and GMI. GMI processing of GEOS met fields takes considerably longer than GEOS-Chem processing and the reason for this is that GMI writes out netcdf files while Geos-chem writes simple binary. Netcdf files allow the writer to save considerable information about the file contents, and although writing netcdf is a time-consuming step, we do not wish to give up the additional information stored in the netcdf format. The other speed issue identified was the use of python scripts (GMI) for processing rather than Fortran (GEOS-Chem). As a result of this meeting, Megan has introduced changes to the processing that have reduced the time by almost a factor of two.

5. FINISH GAS PHASE/AEROSOL, NITRATES – INCLUDE NITRATES IN COUPLING

BIAN, STEENROD. This project is nearly complete. In finalizing the coupling of aerosol chemistry into the GMI mechanism several inconsistencies were uncovered. There were problems with writing some of the diagnostic output and with NH_3. The NH_3 problem was caused by KMG marking constituents

as active or inactive, depending on whether they were in the gas phase chemistry. NH_3 is only emitted and converted into aerosols outside of SMVGEAR, so it was marked as inactive. But inactive species cannot be emitted if the in-chemistry emissions were turned on. This has been recoded and is currently being tested. We are also implementing coarse mode nitrate by including heterogeneous reaction of nitric acid on aerosols.
At present we are using an e-folding loss rate for sulfate to prevent it from accumulating in stratosphere; however, this approach creates problems for the budget analysis. We are evaluating another method to treat stratospheric sulfate by resetting its effective radius based on satellite observation, then allowing it to sediment from the stratosphere to the troposphere.

6. Make GMI CTM code modifications to allow EC met fields. Run 2 year EC experiment.

PRATHER, STEENROD. The initial work to process 2 years of EC met fields has begun, but this project will be highest priority once item 5 (above) is completed. The model must be recoded in order to will read in and correctly use the EC met variables. The fields will be tested in the GMI model using synthetic tracers (see item 8).

7. Incorporate AM3 met fields, in a manner similar to ECMWF

Hongyu, Choi, Steenrod. Hongyu and Hyun-Deok Choi (LaRC) are consulting with Steve to determine what changes the GMI code will require for use of the AM3 met fields. Steve will implement the needed changes (after item 6), and test simulations will use the synthetic tracers described below.

8. Identify and implement a standard set of tracers for use in intercomparing all new runs.

Steenrod, Prather, Strahan, Choi, GMAO, OTHERS. Michael Prather has suggested a set of tracers to be used for basic tests of advection in new met fields. Some tracers under consideration, and that have already been implemented, are (fossil fuel) fCO2, Synoz, ^{222}Rn, ^{210}Pb, and ^{7}Be and ^{10}Be. Michael also proposes a new tracer with a 90-day lifetime, e90, which would be easy to set up. Linoz has been proposed but would require more time and effort (recoding) than the other tracers. Also, CH_3I, which has been previously used by GMI, may be used as a test of convection. Final decisions on the suite of tracers have not been made. The plan is to run a suite of tracers whenever new met fields are introduced to the GMI model in order to compare their advection (and convection?) with previous simulations. Recoding of the CTM is needed so that all tracers can be run at the same time (not currently possible). We need a standard set of observations, as much as possible, for evaluation model tracer runs.

B. Longer timescale term action items (6-? month timescale)

1. **Simulations with new Met Fields**
   a. **MERRA (pre-2004)**
   b. **EC fields**
   c. **AM3 fields**
2. **Hindcast Simulations (~1990-?)**

   a. **GMI CTM or GEOS5-Replay?**
   b. **New emissions**
3. **Future/climate Simulations for AR5**
4. **Tests with new advection (AdvecCore)**
5. **Updates to FAST JX**
6. **New Wet Deposition Scheme**
7. **Integrate the ISORROPIA-II model in GMI to improve representation of the effects of dust and sea salt on nitrate. This is relevant to future work on secondary organic aerosol.**
8. **Isoprene chemistry**